RESEARCH ARTICLE

EFFECTS OF RURAL CREDIT IN BRAZILIAN AGRICULTURE: THE PRONAF CASE

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ARTICLE INFO	ABSTRACT
	The access to rural credit in the last decade has improved the Brazilian and the Rio Grande do Sul State productivity indexes. The objective of this study is to identify the lines of rural credit had some significant contributed to the soybean yield in State. Therefore, it was used the structural model known as Shift-Share to capture the different impacts on variable rural credit comparing data from 2000 to 2011. The results indicate that the contracts effects declined during the period. However, the average rural credit effect accounted for a significant portion of the amounts accessed credit, influencing the positive results observed in soybean yield in the State, so that the productivity effect was higher than the contract effect, but was lower than the average value of the impacts of agricultural loans designed to producers. Hence, there was a reduction in access to credit agreements and a significant increase in real and nominal value of credit influencing productivity.

INTRODUCTION

The agribusiness overcome daily challenges to keep in quality and sustainability. With the opening of international trade in the 1990s agribusiness is contributing significantly to the surplus of the national trade balance. With the increase in productivity and more interaction between industry and the grain trade, associated with the processing of agricultural products, the agriculture proved to be strong and necessary for the growth of Brazil.

The Brazilian agribusiness is an important sector of the national economy. Not only with the production of grain, but relying on a large industrial sector, with manufacturers of agricultural equipment beneficiation and storage grains industries, and technological innovation between seeds and chemical inputs for productivity guaranteed. Using all these tools available, the Brazilian agribusiness exports several commodities, mainly grains "*in nature*", supplying much of the external demand.

The agribusiness Gross Domestic Product (GDP) has grown in each crop, and it is observed that, in 2013, 22,8% of the national Gross Domestic Product was represented by the agricultural sector (VALOR ECONÔMICO, 2013). On grain yield, according to Rezende and Helfand (2000), the harvested area between 1980 and 1990 was the same, but the total production amount grew steadily.

The relationship between acreage and domestic production is clearly discrepant. Between 1990 and 2013 the growth in acreage was 8.4%, rising from just under 40 hectares plant for closet to 60.000 hectares. The production grew 14,8% in these 23 years analyzed, from 60.000 tons to over 180.000 tons. The real difference between cultivars and productivity is 6,4%.

According to the Systematic Survey of Agricultural Production made by IBGE (2013)[1] in 2013, the southern region was responsible for 39.5% of agricultural production in the country. And, Rio Grande do Sul State (RS), the third largest producer of grains in Brazil, with 15,7% of national production. The RS had productivity of 11.718 million tons of soybeans in a cultivated area of about 4 million hectares.

It is common to think of GDP and the share of agriculture in this growth rate, when it comes to productivity and costs. Thus, it is necessary to ensure family farmers access to cheap

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[1] "IBGE is an official institute of statistics for the country, including the unemployment rate, national accounts and social indicators."

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credit and easily obtainable to improve the volume of Brazilian production and, so, provide better living conditions for society.

In this scenario, family agriculture has an important role because, currently, the production of domestic commodities is relevant for the maintenance of family farming, being the main source of income and employment generation in many parts of the country.

The increased crop productivity in Brazil reflects in the world food supply. It is known that the world's food productivity is still lower than consumption needs, thus, the productivity gains that Brazil has shown helps to ensure its leading position among the major food producers and exporters in the world.

Thus, some programs to encourage the increase grain yield were created by Brazilian Federal Government. Actions, such as the Programa Nacional de Fortalecimento da Agricultura Familiar (National Family Farming Strengthening Program, hereafter Pronaf) and Lei da Agricultura Familiar, Seguro Rural, Assistência Técnica e Extensão Rural (Law of Family Agriculture, Rural Insurance, Technical Assistance and Rural Extension, hereafter ATER), so that producers of all profiles, from the familiar to the employer, have access to credit and expert assistance within their property.

Thus, the "Programa Nacional de Fortalecimento da Agricultura Familiar" (PRONAF) searchs to be an interven or in the grain production and encourage small farmers to remain in the field. The program was created in 1990 during an economic situations of commercial stabilization, industrial modernization and strong economic crises, such as destabilization of the currency and unreliable inflation rates. To Gazolla and Schneider (2013), the PRONAF emerged as main policy economic and productive support for family farms, and other policies were created from this, such as the Programa de Aquisição de Alimentos (Food Acquisition Program, PAA), the Lei da Agricultura Familiar, Seguro Rural, Assistência Técnica e Extensão Rural (Law of Family Agriculture, Rural Insurance, Technical Assistance and Rural Extension, ATER) and, recently restructured, the Programa Nacional de Alimentação Escolar (National School Feeding Programme, PNAE).

With larger access to Pronaf lines, of family farming has gotten incentives for maintenance of the producers on farms. However, what has been the real impact of incentives on the state's grain yield? This work aims to identify if the lines of rural credit of the Pronaf had significant contribution to grain yield in the Rio Grande do Sul State.

MATERIALS AND METHODS

The Rio Grande do Sul State is the third largest soybean producer in the country and one of the largest rural credit borrowers nationally available, and therefore, it is relevant to analyze to analyze the effects of productivity, contracts and average credit values.

The information used in the preparation of the results were taken from institutions such as the Brazilian Central Bank (hereafter, BCB), It were used tables of the Statistical Yearbook of Rural Credit, for the period 2000-2011. Productivity and acreage information were sought in the Rio Grande do Sul Socioeconomic Atlas, published by the Department of Planning, Management and Citizen Participation (hereafter, SEPLAG) of the state. The data were deflated based on the broad national consumer price index (IPCA)[2].

The shift share model is a statistical analysis that can be used in several fields of knowledge. The analysis performs the breakdown of rates of change in sources of knowledge, also, searches to illustrate the credit value of behavior by the decomposition of the factors that are responsible for the variation of rural credit.

To separate the contracts effect, productivity, credit growth rate, from the amount of available credit, it was used the shift share model, also known as differential-structural model. Thus, the relative importance of each component on the increases or decreases in credit amount can be estimated. The shift share model aims to ascertain the variation between two points, usually on an annual basis, that are determined as the initial period and the final period. Thus, the value of rural credit weighted by soybean productivity can be set for the initial period for:

$$VCRt_0 = Ct_0 Rt_0 VMCt_0 \qquad (1)$$

and for the final period as:

$$VCRt_1 = Ct_1 Rt_1 VMCt_1 \qquad (2)$$

where VCR is the amount of credit used weighted by soybean yield (R\$); C shows the number of signed contracts (contracts); R is the soybean production productivity (kg/ha) and VMC is the average amount of credit provided to the producer (R\$/contract).

Considering a change in the number of contracts signed in the period t_1 the value of the weighted rural credit would be computed as follows:

$$VCR^C t_1 = Ct_1 Rt_0 VMCt_0 \qquad (3)$$

If the variation in the period t_1 occurred in the signed contracts and on soybean yield, keeping constant the average amount of credit, the value of the weighted rural credit would be given by:

$$VCR^{CR} t_1 = Ct_1 Rt_1 VMCt_0 \qquad (4)$$

The total change in rural credit weighted between periods t_0 and t_1 it would be

$$VCRt_1 - VCRt_0 = \left(Ct_1 Rt_1 VMCt_1 \right) - \left(Ct_0 Rt_0 VMCt_0 \right) \quad (5)$$

Or

$$VCRt_1 - VCRt_0 = \left(VCRt_1^C - VCTt_0 \right) + \left(VCRt_1^{CR} - VCRt_1^C \right) + \left(VCRt_1 - VCRt_1^{CR} \right) \quad (6)$$

where $VCRt_1 - VCRt_0$ the total change in value of rural credit is weighted; $VCRt_1^C - VCRt_0$ shows the contracts effect; $VCRt_1^{CR} - VCRt_1^C$ represents the productivity effect and $VCRt_1 - VCRt_1^{CR}$ captures the average value of credit effect.

The explanatory effects can be converted in the form of annual growth rates, which together result in the annual rate of change of the value of rural credit weighted. Thus, is defined:

$$VCR = \frac{\left(VCRt_1^C - VCRt_0 \right)}{\left(VCRt_1 - VCRt_0 \right)} + \frac{\left(VCRt_1^{CR} - VCRt_1^C \right)}{\left(VCRt_1 - VCRt_0 \right)} + \frac{\left(VCRt_1 - VCRt_1^{CR} \right)}{\left(VCRt_1 - VCRt_0 \right)} \quad (7)$$

To obtain the growth rate between two periods (r) it can be used:

$$r = \left(\sqrt[t1]{VCRt_1 / VCRt_0} - 1 \right).100 \quad (8)$$

Performing the multiplication of the equation 7 by the growth rate between the periods there are obtained the contracts effects, productivity and average value of credit expressed as percentages per year, according to equation 9.

$$VCR = \left[\frac{\left(VCRt_1^C - VCRt_0 \right)}{\left(VCRt_1 - VCRt_0 \right)} \right] r + \left[\frac{\left(VCRt_1^{CR} - VCRt_1^C \right)}{\left(VCRt_1 - VCRt_0 \right)} \right] r + \left[\frac{\left(VCRt_1 - VCRt_1^{CR} \right)}{\left(VCRt_1 - VCRt_0 \right)} \right] r \quad (9)$$

Thus, the different effects that are expressed in annual growth rate are decomposing (%):

$$\text{Contracts Effect} = \left[\frac{\left(VCRt_1^C - VCRt_0 \right)}{\left(VCRt_1 - VCRt_0 \right)} \right] r \quad (10)$$

$$\text{Productivity Effect} = \left[\frac{\left(VCRt_1^{CR} - VCRt_1^C \right)}{\left(VCRt_1 - VCRt_0 \right)} \right] r \quad (11)$$

$$\text{Average value of credit effect} = \left[\frac{\left(VCRt_1 - VCRt_1^{CR} \right)}{\left(VCRt_1 - VCRt_0 \right)} \right] r \quad (12)$$

According to Igreja, Rocha, Braga, Otsuk and Schammaass (2014) the most appropriate methodology for labor analysis of objectives is the Shift Share model, or structural-differential, and this model has been used in the economic literature to achieve general indicators of growth and regional development. In the Case of sectors, such as agriculture, it is customary to use data collection and temporal cuts as it helps identify indicators of agricultural growth.

This study is a descriptive research with quantitative basis which is commonly used to check sources of growth of the agricultural sector from several Brazilian States. It will be used the analysis of the method Shift Share to separate the individual contracts, productivity effects and Average value of credit effect.

RESULTS AND DISCUSSION

Rural Credit

The main objective of rural credit is to stimulate rural investments, strengthen the agricultural sector, encouraging the growth of technology on properties, aimed at increasing productivity and improving the rural population living standards. Through the credit, it's possible to defray expenses of conventional production cycles goods and services investments, and, also, commercializing to cover post harvest expenses (BACEN, 2014).

The importance of creating monetary policies to encourage national productivity made possible that, in 1990, the PRONAF was created as expressed Azevedo and Pessoa (2009) "In Brazil, public policies for rural areas have tended to prioritize commercial farmers at the expense of family farmers". Thus, it is understood that the PRONAF, is a policy which has in fact contributed to changes and improvements in the agricultural sector in Brazil.

The implementation of PRONAF in 1996, is one of the main evidences of changes in the focus of implementation processes of public policy for the Brazilian countryside. Therefore, the program covers farmers who have ownership, lease, concession partnership, settlers, dealers of public lands and landowners, using the family labor in the production process.

For Souza *et al* (2013), the Agricultural Census 2006 showed that family farming accounts for more than R$ 54 billion of the total value produced by the Brazilian agribusiness, offering jobs opportunities and income for 12.3 million people. Hence, it is possible to observe that until the mid-1990s there was no public policy geared to the needs of family farmers.

Since its inception, the program has been critical of target and object of study of several papers, which point out limitations and distribution deficiencies and profitability. For Souza *et al* (2013 cited MATTEI, 2005; GUANZIROLI, 2007) "One of the main criticisms of the program refers to the distribution of resources between regions and between types of family farmers. Studies have shown that the states of the South capture more resources". This region accounts for about half of the amounts allocated to the PRONAF.

According to Schneider, Mattei and Cazzela (2004) the program aims to strengthen family farming, providing technical and financial support to promote larger rural development, thus, contributing to job creation and income,

ensuring better social conditions for the worker's field. From the operational perspective, it's necessary to know that the PRONAF has four main lines of action: costing and investment credit; Infrastructure financing; professionalization of farmers through courses and research funding and rural extension, transferring technology among producers.

It is also important to mention that as the program displays lines of action, also requires that beneficiaries comply with the prerequisites for access to credit. They must have 80% of family income originated from rural activities; explore a maximum of six modules depending on the type of operation of the establishment; be owner, tenant, sharecropper or partner; use family labor, with a maximum of two employees; reside in or near the property; and have gross family income of up to R$ 60.000/year.

But, for the program to be really attractive to the target audience, the country played a major role in the equalization of interest rates and administrative expenses. Still, as Schneider, Mattei and Cazzela (2004) the mode called financing of production, is focused on the financial support of family farmers, following six categories of beneficiaries. This division of the categories happened as a result of a study by a covenant FAO/INCRA (1999) that suggested the targeting of beneficiary farmers. Thus, it is possible to divide the benefit according to the gross income of each group, adjusting financial charges and discounts, according to the difficulties of financial and productive performance.

After segmenting the farmer who makes use of the service, it were also created, in 1999, three special lines of credit to the beneficiaries of groups B, C and D. The first line is the revolving credit, operated by the Bank of Brazil, which works as a conventional overdraft, and allows the farmer to use his credit limits as needed.

As expressed by Schneider, Mattei and Cazzela (*apud* Abramovay, 2002, p.38) "in 1997 revolving credit accounted for 37% of the value of PRONAF costing loans, and in 2000 it already reached 52% of the total". The second line of credit availability is for associations and cooperatives composed of program beneficiaries, and the third line is the "PRONAF MAIS ALIMENTOS[3]", which has among the main projects incentives to marketing, services, etc.

It is also important highlights that the values of the contracts change a lot of between the units of the federation, showing the different crops and locations financed by PRONAF. Observing the year 1996 as a base, it can be observed a tendency to concentration both, the number of contracts, 78%, and the concentration values (65%) in the South.

This strong imbalance is explained by Schneider, Mattei and Cazzela (2004) for two main reasons, namely: the economic burden that the region has on domestic production, and the political change of the farmers on the bodies responsible for the allocation and sharing of resources; as well as the

organization of family farmers and the biggest fights in favor of rural credit.

Effects

Since the Rio Grande do Sul State has 378.546 establishments belonging to family farms and a vast area of 6.171.622 ha of cultivation, it is easy to think that the RS has great potential to concentrate the use of credit lines between 1998 and 2010, 3.998.220 contracts were applied, with average values of R$ 3.850,00 each. Program data point to a concentration of resources for specific activities, such as corn crop accounting for 46%, and soybeans for 30% of the financial resources available in 2006.

As presented in Table 1, the values for the three effects analyzed in the can be observed. It was–used the period of deflation techniques between 2000 and 2011 for the calculation of the actual values, and it were used inflated values for the calculation of nominal effects.

The analysis shows that the Contracts Effect is negligible, for real and also for nominal value. Thus, the Contract effect had a negative change of -8,5% in real case and -2,6% for nominal effect. In the case of the analysis of the productivity effect, the amounts were significant for soybean production in the state.
With an increase of 34% in planted area, it's possible to verify an increase of 119% in the state production in tons of soybeans, starting from the amount of 4.783.895 tons in 2000 to 11.717.548 tons in 2011, according to Socioeconomic Yearbook of Rio Grande do Sul (2014). Thus, the productivity effect has a nominal increase of 26.4%, and a real increase of 7,9% showing that the model is valid if analyzed factors such as cultivated and harvested production area.

Table 1 Real and Nominal Results for the Contracts Effects (EC), Productivity Effect (EP) and Average Credit rural Effect (EVMC) for soybean production

	EC	EP	EVMC
Real Effect	-8,5%	26,4%	82,2%
Nominal Effect	-2,6%	7,9%	94,7%

Source: Research Data (2014)

To Feux and Vanin (2014), it's verified two major trends for agricultural production in the RS. The first is the ability to impressive gains through productivity, since the productivity effect had real increase of 26,4% in the eleven years of the study period, indicating a yield on the three main crops of the state in terms of area (soy, corn and wheat). The second major trend in the State, is the overall growth in soybean and wheat cultivation, which became significant from 1990, with the possibility of international marketing. It is possible in this area also relate the increase in the effect of the average value of the credit, since programs like PRONAF may be destine for the purchase of inputs and outputs that indicate increased productivity, and also for agricultural machinery and implements, which ensure greater reliability to the producer at the time of plant and harvest.

The average credit rural effect of the contracts was the index with the highest increase in the period analyzed, with percentages that reach more than 94% with nominal effect and over 80% with real effect. So, even with the decentralization

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[3] "Is the PRONAF credit line financing investments in productive infrastructure of family property".

policy of the PRONAF, is still significant the increase in the value of contracts signed in Rio Grande do Sul State. The information cited can be viewed in Figure 1.

Based on researched information, it's verified that the increase ratio of the Contract Effect Mean Value Effect is relative to the increase in productivity of the commodity in the agriculture of the RS.

With the results of empirical analysis of the Shift Share method it's observed that this concentration became apparent. Despite the use of financing programs decentralization policies, the RS has its production based on government funds. Data of Statistical Yearbook of Rural Credit (2014) show that, when comparing the cost of credit values and investment between the years 2000 and 2011, it`s clear the increase of 505%, which proves the increase factor Contract Effect Mean Value Effect.
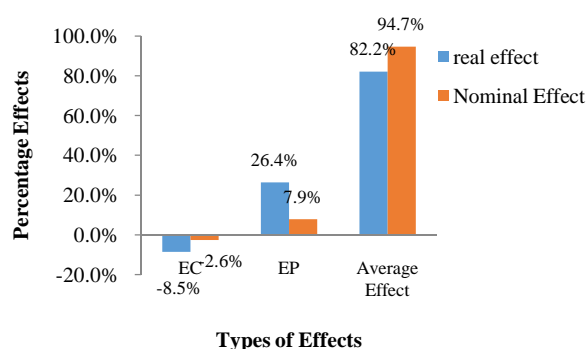

Figure 1 - Graphic representation of Real and Nominal results for the effects on the value of weighted credits by soybean yield.
Source: Research Data (2014)

With all this volume of credit, it becomes possible to invest in new technologies for farming, which help prevent crops with low yield due weather climate or the devastation of production because of biological factors. This makes RS productivity further, as shows the productivity effect, with real increase of 26,4%, and within the period under review, increased 119% in the state's productivity. Therefore, it is still necessary to observe that the increase in value of the contracts does not result in an increase of committed contracts, which suggests that the PRONAF values are being centralized in a few credit agreements.

Thus, the amounts invested in programs and funding for agriculture tend to return in grain yield, especially in the case of the Rio Grande do Sul State.

CONCLUSIONS

With fiscal and monetary aid, production in Brazil increases in each harvest season after season. The wide availability of land, skilled labor and lower costs than in other countries, makes the country increase its production rate gradually.

Brazil has advantages over climate seasonality and on pests that can appear during the growing season because of its large territory, thus, even if a large farming is destroyed by some

cause, other cultivars may have had all necessary conditions for maximum crop yield.

On the productivity of the Rio Grande do Sul State, the farming area showed small increase between the years 1973 to 1999, from 16,7 million tons to 37,1 million in 1999. It's noticed stagnation until 1980, with a substantial increase in 1990, which increased productivity in the RS.

To separate the effect contracts, productivity, credit growth rate from the amount of available credit, it was used the shift share model also known as differential-structural model. Thus, it`s possible estimate the relative importance of each component on the increases or decreases in credit worthiness.

Estimating the model, it can be noticed that the Contract value increased by 94% in real value (deflated) and above 80% in nominal value, so it is possible to say that the Rio Grande do Sul State is still a major borrower of rural credit, but, being the third largest producer of agricultural commodities, is consistent reasons for that as the increased productivity effect in 26,4% in real value, and close to 8% in nominal value.

Therefore, the actual increase in the average value of contracts had a significant impact on productivity, since it were signed less contract in 2011, compared to 2000, but with higher values, which provided greater access of producers to the technology used to improve productivity and, with this, the profitability of farms.

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